THE LABORATORY

PHANTOM in Dr. M. S. Potsaid's hands will respond to radiation just as human tissue would, showing effects by distinct color change. Made of special waxy formulation, it's an accurate new dosimeter for Space Age medicine. Silvered plaster casts (center, right) served as models.

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THE LABORATORY®

for the latest developments in instrumentation and technique

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Dr. Maj casts a phantom

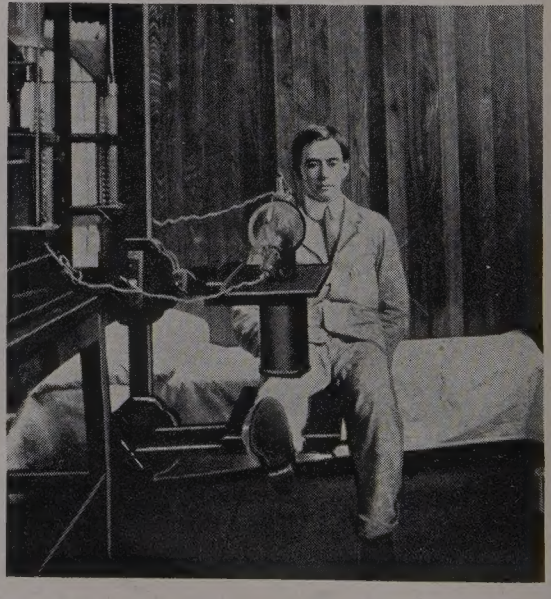
WHEN Majic S. Potsaid, M. D., slapped cold plaster on the face of his assistant—who lay on a cot in the laboratory with a towel over his shoulders, breathing through straws in his mouth, resigned to the dictates of research—the assistant was in for a rough time.

Dr. "Maj," a radiology scientist at Massachusetts General Hospital and instructor at Harvard Medical School, was no sculptor. It took nearly an hour for him to make a mold of the face of his patient-but-perspiring Japanese research fellow, Dr. Goro Irie. But it was worth it.

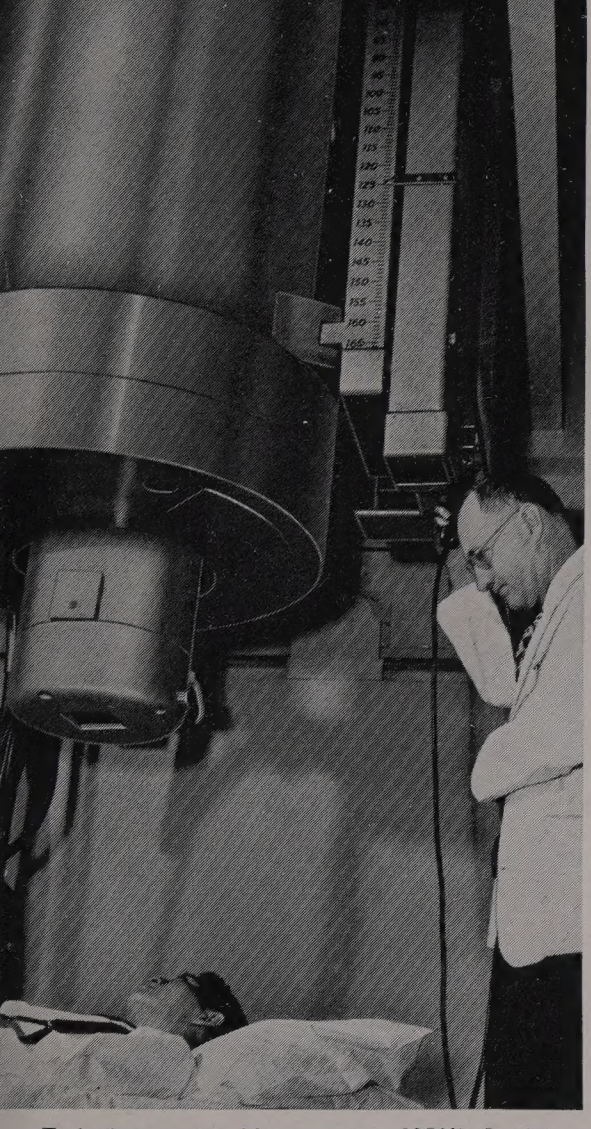
When Dr. Maj later cast a solid likeness of Dr. Irie, using not bronze but a peculiar color-changing waxy formulation, and completed certain tests, Space Age medicine received a remarkable tool for radiation detection and control.

▶ What Dr. Maj had produced was a colorimetric "phantom," with the density of human tissue, and with a yellow "complexion" boasting well-nigh human sensitivity to radiation.

After a single exposure to almost any kind of ionizing radiation, the phantom immediately changes from yellow to red, with the color intensity proportional to the *amount* of radiation; the color penetration proportional to the *depth* of radiation; and



Roentgenology experiments at Massachusetts General Hospital began 1896, a year after discovery of x-ray. MGH's great self-taught 'radiologist', William James Dodd, became a master of the new tool and, with over-exposure, its victim as well.



Today's x-ray machines, such as MGH's 2-million-volt unit, are major tools in cancer treatment.

the color area delineating the *field* of radiation.

In short: an accurate 3-D picture of what happens to human tissue under ionizing bombardment.

The dosimeter is the phantom and the phantom itself is a dosimeter. No further treatment, such as developing, is necessary. What's more, this chemical "in-phantom dosimeter" is inexpensive, can be wrapped in dark paper and stored in a cool place as a reference for future therapy.

Since the day Dr. Maj "sculpted" a likeness of his colleague to study what would happen to a human head under massive radiation bombardment for a deep malignancy (he got a vivid, accurate picture), he has been casting models of hands, noses, arms, legs—in fact, replicas of just about all body areas, using art-school plaster models, then "real" patients scheduled for radiation therapy at Mass General.

The research and control applications of the Potsaid-Irie Dosimeter, as it's called, are far-reaching; the immediate ones are, of course, in the radiation treatment of cancer. Here, the dosimeter has proved a valid "stand-in" for man, already reducing significantly risks from the massive radiation required for drastic therapy.

Germs de-throned

Today, germs have ceased to be the principal enemy of man; chief causes of suffering and death are diseases like rheumatism and cancer, in which the organism's "inner balance" is upset.

By a series of brilliant experiments—perhaps the most significant performed thus far in the 20th Century—biologists have recently explained the basic molecular mechanism through which both hereditary characteristics and virus infections are transmitted. Such understanding may well lead to impressive advances in the understanding of cancer as well.

But all this is in a long-range view. *Right now, the bright news in cancer work is that through the combined efforts of chemist and radiologist, we are able to deliver powerful radiations to pathologic cells to suppress cells that have undergone morbid change.*

Increasingly precise methods of diagnosis, combined with more selective radiation therapy, should lead to a higher proportion of clinical successes, with most forms of malignancy, probably within the life-span of the generation now being born.

To that end, vast international programs for utilization of high-energy machines for cancer therapy are in progress, with protons from huge cyclotrons replacing surgeons' scalpels to retard or destroy deleterious action even by such organs as the pituitary gland.

How the phantom itself is the dosimeter is shown by this wax-chloroform-dye "portrait" of Dr. Irie. Plaque containing radium slugs was placed on cast at left, instantly produced tone pattern of irradiated area (right).

Needed: a detective

The story of the Potsaid-Irie Dosimeter and its contribution to the exciting field of radiation started some 4 years ago—in 1957—when Dr. Maj suggested a *neutron* source of plutonium-beryllium instead of traditional *radium* for treating cervix cancer (neutrons might possibly give more uniform dose distribution, and, unlike photons, may not be as strongly affected by the inverse square law).

Asking physicists what the dose patterns would be from a particular neutron source, Dr. Maj discovered that there was uncertainty about how the radiation effects would be distributed. He reasoned that a solid chemical dosimeter simulating human anatomy might shed some light on this and other problems in radiology. The search was on.

The problems were many. Over 1000 different nuclear reactions are known; hundreds of radioactive isotopes have been prepared artificially, and in the medical arsenal are *positively*-charged alpha particles, deuterons and protons; *uncharged* particles such as neutrons; speed-of-light *electromagnetic waves* such as the photons of x-rays and gamma rays; and *positive and negative electrons.*

Yet ionizing radiation can be detected only by its action on matter; except for high doses, no immediate result is observable. With moderately large doses, "radiation sickness" may appear in several hours, skin redness in a day, changes in blood in a few days, hair loss in a week. Even with relatively large doses, death may not occur for a month, cancer formation may not be evident for years.

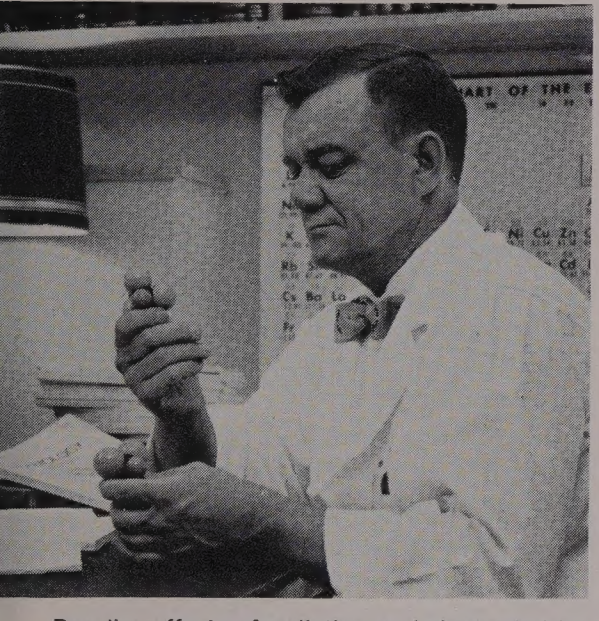
Hence, a dilemma. Doctors often have to irradiate malignant tumors with beams from x-ray machines or betatrons. For "close-up" therapy, they may even have to implant tiny radon-filled slugs or other radioactive materials right in the malignancy itself.

But how can one make absolutely sure, immediately, that an effective dose is reaching the tumor . . . or that the rays are not unduly affecting healthy tissue? (Might

not enough rays from a radium slug in the abdomen penetrate to the breastbone—a vital source of red blood cells?)

To answer these questions, Dr. Maj began his search for a 3-dimensional colorimetric chemical dosimeter, experimenting with hundreds of substances in an attempt to simulate human tissue: polystyrene, methyl methacrylate, polyvinyl alcohol, methylcellulose, starch, alginates, any gelatin systems he could get his hands on. . .

Simultaneously, he experimented with a colorimetric system sensitive to radiation, concentrating on halogenated hydrocarbons, especially chloroform, which has the pleasant habit of liberating chlorine to



Peculiar effects of radiation on halogenated hydrocarbons pointed to their use in the phantom.

form an acid in proportion to the amount of radiation energy absorbed.

The needle did it

Last year, when Dr. Maj and his assistant had just about exhausted all the available materials in the search for a human tissue substitute, they glanced at something that had been staring at them for months, "just begging to be tried": the omnipresent slabs of paraffin used in the lab for mounting and sectioning tissues for microscopy.

Paraffin, of course, offers problems of internal cracking and flaking, which the doctors attempted to solve by adding wax. They then discovered that a non-cracking, non-flaking paraffin-wax formulation was commercially available in Tissuemat®.

One evening, the doctors left a Petri dish of the paraffin-wax formulation—to which chloroform and a methyl yellow dye had been added—atop the lab bench, *with a radium needle on the dish.* Next morning, they found a 3-dimensional red pattern in the dish, showing—when the waxy disc was sliced—exactly how the rays from the needle had penetrated!*

The doctors' delight was of the order of that of radiology's founder, Wilhelm Konrad Roentgen, when he found the now-famous black line across a sheet of barium platino-cyanide paper on his bench, and discovered the x-ray.

Thereafter, during the spring and summer of 1961, a steady stream of custom batches of Tissuemat, each embodying different amounts of ingredients as specified by Dr. Potsaid, passed between the Fair Lawn, N. J., plant of the Fisher Chemical Manufacturing Division, whose reagent researchers had been infected with the Bostonians' own zeal and fire, and the Radiology Laboratory at Mass General.

Not all the phantoms were as elaborate as the portrait of Goro Irie. The hundreds of experimental phantoms were usually poured—melted—into small rectangular aluminum molds greased with silicone.

The solidified light-yellow slabs were then irradiated by a variety of x-ray sources; by a cobalt-60 teletherapy unit; by radium slugs employed in radiation therapy; by a strontium-90/yttrium-90 "plaque."

Recorded by the never-blinking dosimeter were the effects of "multiple fields" (the rotation of the radiation source that doctors employ to spare normal tissue from

**In the Petri dish, radiation had supplied the energy for the chlorine atoms in the chloroform ultimately to link up with the nitrogen atoms in the azo (methyl yellow) dye, furnishing a distinct color complex.*

Reagent researchers at Fisher chemical manufacturing division compare variety of formulations for solid phantom for pinpointing irradiation.

damage) on the dose in various parts of a particular geometric shape.

In fact, the dosimeter acted as a "monitor" on the state of the instrumentation itself. It seems that during one of the first trials of the dosimeter, Dr. Maj noticed fuzzy edges of the radiation field produced by a beam from an x-ray unit that had just had a new tube installed. The dosimeter revealed that the focal area was 4 times larger than it should have been because a resistor had not been replaced!

In another instance, the lab-made dosimeter even revealed a slight misallignment of mirrors when the intricate x-ray unit was in certain positions!

A look ahead

What Dr. Maj foresees for his solid phantom radiation dosimeter is full-time use not only in routine problems in radiology (where's the dosage going in the patient?) but in teaching and in research. It will certainly help uncover heretofore uncharted distributions of absorbed radiation dosages in unusual bodily formations.

In addition, the Potsaid-Irie Dosimeter is expediting a variety of research projects:

▶ *Determination, by electron magnetic resonance techniques, of the amount of free radicals formed in irradiation of the phantom, and their possible relation to the vivid color change and to radiation effects in general.*

▶ *Study of the curious relation of oxygen —and the lack thereof—to radiation effects.* Small amounts of oxygen intensify color change in the phantom mixtures.

▶ *Demonstration of color patterns produced in phantoms by beams of slow neutrons, a relatively new and elaborate type of treatment.* Importance: cells of brain tumors concentrate 4 to 5 times more boron than other cells do, and slow neutrons from a uranium-graphite reactor, aimed at the tumor, will split boron-10 nuclei to liberate alpha particles plus lithium atoms. So, this transmutation-in-miniature generates a supply of alpha rays neatly confined to the tumor area, where they do the most good.

▶ *Visualization of the so-called "Bragg peak" produced by protons and other charged particles.* This effect is shown by the Potsaid-Irie Dosimeter as a distinct red peak that ends abruptly after a certain penetration—ends at full force, so to speak, with no tapering off. As you would surmise, this kind of radiation offers a fine way to build up two-to-three times more dosage than usual, right at the area to be treated; thus, it has wonderful possibilities

for treating malignancies deep inside the human head.

▶ *Study of the role of water in radiation.* All living things have water; water has, in fact, been called "THE molecule of life." (Indeed, many investigators try to explain radiation by its effect on water systems that *in turn* affect particulate systems.) The phantom dosimeter will permit researchers to study the effects of radiation on water, since the device is extremely sensitive to traces of water.

▶ *Finally, there is, in sight, the enticing prospect of developing a quantitative spec-*

More to come: heavy-radiation centers for medicine. This one, proposed for Mass General, will house cobalt, linear accelerator, betatron units.

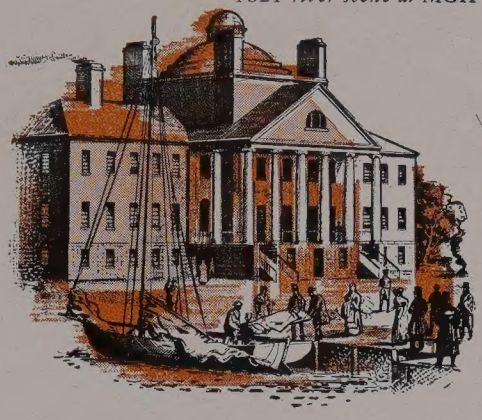
trophotometric method to measure absolute dosage (it's all been relative, till now), using the color changes in the unique phantom dosimeters.

Postscript

This July, Oak Ridge National Laboratory celebrated its 150,000th shipment of radioisotopes. More than 1,300,000 curies of radioisotopes and 500,000 milligrams of enriched stable isotopes have been distributed by the laboratory since "opening day," July 1946.

Today, with increasingly ingenious controls and with increasing know-how, radiation in medicine and biology—as in agriculture, industry and engineering — promises to bring greater benefits to greater numbers of people, everywhere. ■■

1821 river scene at MGH



BIRTHDAY PRESENT FOR MGH

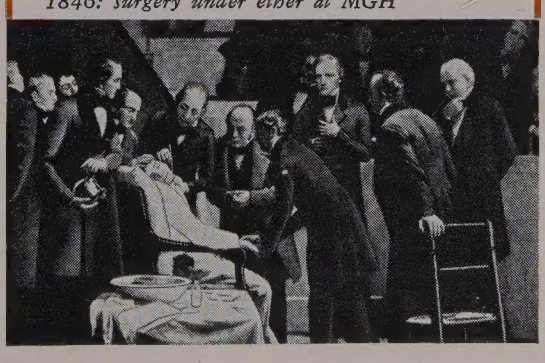
DR. MAJ'S dosimeter was one of several fitting birthday presents to an institution celebrating its 150th birthday: Massachusetts General Hospital, founded 1811. In the years that passed, it grew to international eminence, with shahs, prime ministers and opera stars making transoceanic journeys to its clinics.

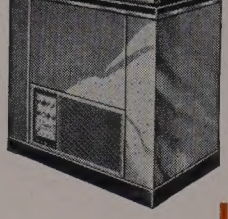
Say "MGH" or "The General" to any Boston cab-driver, and he heads straight for the narrow streets behind Beacon Hill, where hospital and research buildings—some century-old granite, some modern steel-&-glass—spread along the Charles River Basin.

At MGH—where the interdependence of chemistry, medicine, physics and physiology are in constant evidence—research may include the regeneration of a rat's liver or the growth of antlers in a fundamental comparison of normal and cancer cells; the structure of living bone; the origins of rheumatoid arthritis.

MGH was a pioneer in the use of ether, sterile environments, psychiatry, other major advances. It is a working partner of Harvard Medical School, Massachusetts Institute of Technology, Boston College, Boston University, Radcliffe, Simmons, and Smith—to name a few. Thus, it is simultaneously a great community hospital, research institute, teaching center.

1846: surgery under ether at MGH





ISOTHERM BATH
flows hot or cold
FROM 0° TO 100°F

Open the valve, and the new Fisher Isotherm Bath will circulate a gallon a minute of thermostated liquid through a test apparatus. And that's that.

EVERY LABORATORY has to run tests that call for a circulating supply of hot or cold water to regulate the temperature of the test apparatus.

Yet setting up a circulating hot-water bath can be quite a chore. You have to obtain, assemble and adjust tank, heaters, thermostat, relays, circulating pump, hose connections. Below room temperature, it's even harder—there are relatively few practical chilling mixtures.

Now, however, you can get *any temperature* from 0° to 100°F, by using the new Fisher Isotherm Circulating Bath.

The Isotherm Bath will keep 20 gallons of water, oil or any other suitable liquid within ±0.25°F of any desired temperature in this broad range. Its built-in pump will circulate the liquid through a test setup at a rate of 1.6 gallons a minute at zero head, 0.8 gal/min against a 5-ft head.

Cooling capacity is approximately –890 BTU/hr; heating capacity, 2950 BTU/hr.

Short of bench space? Then set your apparatus right on top of the bath. It will hold up to 200 lbs, and the cover of the control compartment opens *independently* of the bath cover, so you always have access to the thermometer, thermostat and valves.

Want to keep bottles, flasks or culture tubes at constant temperature—high or low? An adjustable rack can be set 3″, 5½″ ar 8½″ above the bath's bottom—depending on the size of the bottles.

The Isotherm Bath gets its low temperatures with a built-in mechanical refrigerator whose ⅓-hp single-stage hermetically-sealed compressor circulates Freon 12 through copper coils around 4 sides of the bath. The coils are held away from the walls, so that the bath liquid circulates freely around them.

Above ambient temperature, the Isotherm uses two immersion heaters—a 750-watt heater to bring the bath up to temperature speedily, and a 300-watt control heater.

Stainless-steel tank

The tank is stainless steel, 14½″ by 27″ by 12½″ deep. The heavily insulated cabinet is handsome gray-&-black enameled steel, 22″ front-to-back by 35″ W by 36″ H on its 4 casters . . . its closed top perfectly level with the top of any line-up of Fisher "Unitized" lab benches. Grilles provide air circulation and easy access to the compressor.

▶ Complete, for operation on 115-volt 60-cycle a-c only (1700 watts max.), the Isotherm Bath is $1025.

First, processing chemists take samples of the dye solution while the lot is still in the Fisher manufacturing department, make an actual pH paper swatch, and match it with the standard color chart (new high-fidelity color charts are used).

Then, when the lot of dye solution is finished, the same check is performed by analytical quality-control specialists. Finally, when the finished rolls are ready for packaging, several rolls of the batch are again checked against the standard chart on *each pH range.*

The 15-ft paper ribbons in these "vest-pocket pH-meters," always available, always protected from contamination by lab atmospheres, are ideal for industrial and clinical uses alike . . . from testing liquids in pickling vats . . . to making up culture media.

▶ Alkacid pH-Testers, complete with dispenser, chart, and paper ribbon, are $1.50 each. Paper refills are $1.60 per package of 4 rolls. Catalog numbers of the pH-Testers and refills appear below, for each of the 7 ranges available.

pH RANGE	pH-TESTER, catalog no.	REFILL, catalog no.
0.0 - 3.0	14-837-1	14-837-21
3.5 - 5.5	14-837-2	14-837-22
6.5 - 8.5	14-837-3	14-837-23
9.0 - 11.0	14-837-4	14-837-24
10.5 - 12.5	14-837-5	14-837-25
12.0 - 14.0	14-837-6	14-837-26
2.0 - 10.0	14-834-1	14-836-1

$4.40 per 4-oz unit ($4 each in the handy 6-pack). Fisher 11-130-52 Chromosorb W is available in 300-gm units at the following prices:

Mesh Range	Price	Mesh Range	Price
30-60	$19.50	80-100	$39.50
42-60	19.50	100-120	33.00
60-80	26.25	100-140	29.50
60-100	19.50	120-140	33.00

REXYN: a comprehensive new line of ion-exchangers

WITH THE ACCELERATING numbers of industrial, clinical and research applications for ion-exchange resins, dependable high-purity ion-exchangers are a virtual must for most laboratories.

That's why the Fisher Chemical Manufacturing Division is pleased to announce Rexyn™, *a complete line of high-purity Fisher ion-exchangers, organic and inorganic, including both strong and weak cation, and strong and weak anion resins.*

Two grades are represented in the new line: Analytical Grade (AG) for routine laboratory use; Research Grade (RG), with highest purity and regeneration efficiency, to meet the specifications of research work.

Printed on the label of each bottle is an actual lot analysis of important chemical and physical properties: mesh size, total exchange capacity in milliequivalents (wet

—concluded on next 2 pages

volume and dry basis); moisture content; active working density in grams per liter.

The label of the Research Grade also states the exact percentage of metal impurities present. (Maximum impurities: Fe, 0.005%; Cu, 0.0025%; Na, 0.0025%; Pb, 0.0025%.)

Two noteworthy developments are Fisher Rexyn AG-4 and IRG-501.

Rexyn AG-4 is a unique strong base, ternary amine exchanger designed specifically for uranium recovery; its extra-close tolerances on particle size and shape make for maximum uranium absorption. Rexyn RG-501 turns from blue-green to a red-orange to indicate when the exchanger is spent and should be replaced.

▶ Here's a quick summary of the new line:

CATALOG NUMBER	U.S. STD MESH SIZE	POROSITY	ACTIVE GROUP IONIC FORM	TOTAL EXCHANGE CAPACITY	MOISTURE CONTENT	CHEMICAL TYPE	TYPICAL APPLICATIONS	PRICE
R-228 Rexyn AG-50	16-50	Intermediate low	RSO_3Na	1.9 meq/ml	40-50%	Sulfonic acid, strong acid cation exchanger	Water treatment; catalysis; conversion of salts to acids; inorganic and organic chromatography; determination of total salt concentration	1 lb, $2.34 6 x 1 lb ea, $2.20 5 lb, $10.50 4 x 5 lb ea, $10 25 lb, $35.30
R-229 Rexyn AG-50	16-50	Medium	RSO_3Na	1.9	45-55			
R-230 Rexyn AG-50	40-100	Medium	RSO_3Na	1.9	45-55			
R-231 Rexyn AG-50	16-50	Medium	RSO_3H	1.9	45-55			
R-232 Rexyn AG-50	40-100	Medium	RSO_3H	1.9	45-55			
R-233 Rexyn AG-50	16-50	Low	RSO_3Na	1.9	40-50			
R-234 Rexyn AG-51	16-50		RCOOH	3.5	40-50	Carboxylic acid type, weak acid cation exchanger	Solid buffer for exchange reactions; organic and inorganic chromatography; isolation and separation of organic bases	1 lb, $5.85 6 x 1 lb ea, $5.70 5 lb, $27.50 4 x 5 lb ea, $26.10 25 lb, $96.45
R-235 Rexyn AG-52	16-50		AlO_2Na	0.14	1-5	Processed, natural glauconite cation exchanger	Treatment of water with low total hardness; catalysis	1 lb, $1.95 6 x 1 lb ea, $1.75 5 lb, $6.40 4 x 5 lb ea, $5.80 25 lb, $18.80
R-236 Rexyn AG-53	16-50		AlO_2Na	0.53	40-50	Synthetic aluminosilicate cation exchanger	Folin method for ammonia in urine; water treatment; removal of histamine from blood; purification of antibiotics; concentration or isolation of vitamins; analysis of alkaloids; thiochrome assay for thionin	1 lb, $2.80 6 x 1 lb ea, $2.60 5 lb, $10.80 4 x 5 lb ea, $10.30 25 lb, $37.65
R-237 Rexyn AG-54	16-50		RSO_3Na RCOONa	0.54	40-50	Sulfonated coal cation exchanger	Water treatment; demineralizing and dealkalizing; catalysis (esterification and ester alcoholysis); absorbent and cation exchanger in sugar purification	1 lb, $3.20 6 x 1 lb ea, $2.90 5 lb, $12.65 4 x 5 lb ea, $12.05 25 lb, $43.50
R-238 Rexyn AG-54	16-50		RSO_3H RCOOH	0.54	40-50			
R-251 Rexyn AG-1	16-50	Medium	$R_4N\ ClSO_4$ (alkyl)	0.95	50-60	Strong base anion exchanger (polystyrene alkyl quaternary amine)	Salt splitting; substitution, concentration and separation of amino acids; inorganic and organic chromatography; water treatment; determination of total base in urine and other body fluids; silica removal; removal of mercaptans from hydrocarbons; catalysis in organic synthesis	1 lb, $5.85 6 x 1 lb ea, $5.70 5 lb, $27.50 4 x 5 lb ea,$26.10 25 lb, $96.45
R-252 Rexyn AG-1	40-100	Medium	$R_4N\ ClSO_4$ (alkyl)	0.95	50-60			
R-253 Rexyn AG-2	16-50	Medium	$R_4N\ ClSO_4$ (alkanol)	0.95	45-55	Strong base anion exchanger (polystyrene alkanol quaternary amine)	Same general uses as AG-1, but with better exchange capacity and regeneration efficiency	
R-254 Rexyn AG-2	40-100	Medium	$R_4N\ ClSO_4$ (alkanol)	0.95	50-60			

CATALOG NUMBER	U.S. STD MESH SIZE	POROSITY	ACTIVE GROUP IONIC FORM	TOTAL EXCHANGE CAPACITY	MOISTURE CONTENT	CHEMICAL TYPE	TYPICAL APPLICATIONS	PRICE
R-255 Rexyn AG-3	16-50		R_2NHOH RNH_2OH	1.5	35-45	Weak base anion exchanger (polystyrene amine)	Removal of acids from organic reactions; anion exchange in slightly acid media; separation of anionic complexes of metals; deionization of sugar solutions; amino acid separations; recovery and separation of metals; organic and inorganic chromatography; separation of strong acids	1 lb, $5.85 6 x 1 lb ea, $5.70 5 lb, $27.50 4 x 5 lb ea, $26.10 25 lb, $96.45
R-256 Rexyn AG-4	16-50		$R_4N\,ClSO_4$ (pyridinium)	0.95	50-65	Strong base anion exchanger (quaternary amine containing pyridinium groups)	Uranium recovery; nitrate elution	
R-257 Rexyn AG-4	40-100		$R_4N\,ClSO_4$ (pyridinium)	0.95	50-65			
R-258 Rexyn AG-4	10-20		$R_4N\,ClSO_4$ (pyridinium)	0.95	50-65			
R-259 Rexyn AG-5	16-50		R_3NOH R_4NOH	1.5	55-75	Intermediate base anion exchanger (tertiary and quaternary aliphatic polyamine)	Removal of acids from organic solutions; removal of electrolytes and impurities from vitamin B_{12} and others; catalysis in organic reactions	1 lb, $6.75 6 x 1 lb ea, $6.45 5 lb, $28.40 4 x 5 lb ea, $27.05 25 lb, $107.95
R-260 Rexyn AG-6	16-50		$R_2NH\,ClSO_4$ $R_3N\,ClSO_4$	1.5	45-55	Weak base anion exchanger (aliphatic polyamine)	Removal of acids without formation of undesirable salts; separating glutamic acid from amino acids; fraction separation of acids; catalysis; water treatment; separating anionic complexes of metals; organic and inorganic chromatography	
R-261 Rexyn AG-7	16-50		$R_3N\,ClSO_4$ (phenolic)	1.5	50-60	Phenolic intermediate anion exchanger (phenolic tertiary amine)	Deacidification of formalin; removal of mineral acidity from aqueous and non-aqueous solutions; purification of beta-alamine; recovery of precious metals; purification of sugar solutions	1 lb, $6.75 6 x 1 lb ea, $6.45 5 lb, $28.40 4 x 5 lb ea, $27.05 25 lb, $107.95
R-276 Rexyn AG-501	16-50	Medium	RSO_3H RSO_3OH R_4NH R_4NOH	0.55	50-60	Mixed bed, strong acid/strong base exchanger	Deionizing water (equivalent to triple-distilled water)	
R-201 Rexyn RG-6	16-50		R_2NHOH R_3NOH	1.5	45-55	Same as AG-6	Same as AG-6	1 lb, $5.25 6 x 1 lb ea, $5.10 5 lb, $25 6 x 5 lb ea, $23.75
R-202 Rexyn RG-3	16-50		R_2NHOH RNH_2OH	1.5	35-45	Same as AG-3	Same as AG-3	1 lb, $7.50 6 x 1 lb ea, $7.35 5 lb, $36.25 6 x 5 lb ea, $35
R-203 Rexyn RG-50	16-50	Medium	RSO_3H	1.9	45-55	Same as AG-50	Same as AG-50	1 lb, $6.50 6 x 1 lb ea, $6.35 5 lb, $31.25 4 x 5 lb ea, $30 25 lb, $125 (R-203)
R-204 Rexyn RG-50	40-100	Medium	RSO_3H	1.9	45-55	Same as AG-50	Same as AG-50	
R-205 Rexyn RG-1	16-50	Medium	R_4NOH	0.95	50-60	Same as AG-1	Same as AG-1	1 lb, $7.50 6 x 1 lb, $7.35 5 lb, $36.25 4 x 5 lb, $35 25 lb, $165 (R-205)
R-206 Rexyn RG-51	16-50		RCOOH	3.5	40-50	Same as AG-51	Same as AG-51	
R-207 Rexyn RG-501	16-50	Medium	Mixed Bed	0.55	50-60	Same as AG-501	Same as AG-501	1 lb, $6.50 6 x 1 lb ea, $6.35 5 lb, $31.25 4 x 5 lb, $30 25 lb, $125 (R-207) $140 (R-208)
R-208 Rexyn IRG-501	16-50	Medium	Mixed Bed	0.55	50-60	Same as AG-501	Same as AG-501 with indicator	

a column system for hydrocarbons
a constant-current d-c power supply

TWO BRAND-NEW ITEMS from Fisher's Gas Chromatography Laboratories will increase the versatility and simplify the operation of the Model 25 Gas Partitioner, Fisher's popular analytical chromatograph for mixtures of gases.

The column system

A NEW column system enables the Model 25 to separate a 12-component mixture of "fixed" gases and hydrocarbons through C_5 in approximately 10 minutes.

Swagelok fittings make it easy to install the two new columns in place of those supplied with the Partitioner. The *standard* columns allow the analyst to determine the first 6 gases in the following list; the *new* columns determine all 12.

1. hydrogen
2. oxygen
3. nitrogen
4. carbon monoxide
5. carbon dioxide
6. methane
7. ethane &/or ethylene
8. propane
9. iso-butane
10. n-butane
11. iso-pentane
12. n-pentane

The standard 30″ HMPA column in the Model 25 Partitioner is replaced by a 6-ft HMPA column, while the standard 6½-ft Molecular Sieve column is replaced by a 12-ft composite column containing 5 ft of inert packing and 7 ft of Molecular Sieve.

▶ The new 6-ft HMPA Column (catalog no. 11-134-36) is $15. The 12-ft Molecular Sieve Column (catalog no. 11-134-37) is $35. Both columns are required.

Check "Hydrocarbon Columns" on the reader-service card for detailed performance data on the new column system. Check "Fisher Gas Partitioner" for a fully-illustrated booklet on the instrument itself.

The power supply

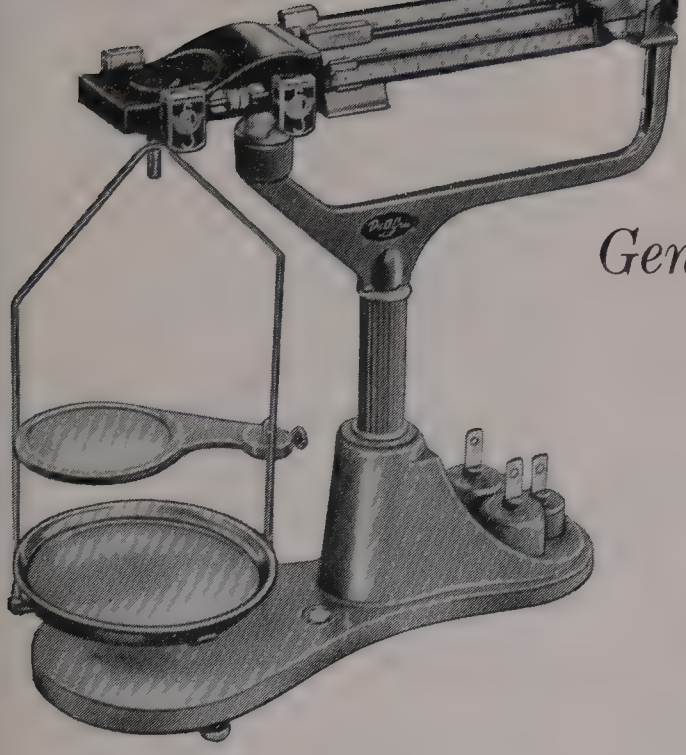
ANY CHANGE in the current through the thermal conductivity cell of the Gas Partitioner introduces an unknown error in analyses—hence current is ordinarily supplied from a 7.5-volt battery.

Now, a new accessory makes it possible to eliminate this battery and operate the Partitioner on any 105-130 volt, 50/60-cycle a-c line. The Constant-Current DC Power Supply will supply cell currents of 5, 7 or 9 milliamps, with a variation of only ±0.5%—just by turning a selector switch.

Using the Constant Current Supply, it is no longer necessary to shut off the current to the detector when the carrier gas isn't flowing—*the thermistors can't be damaged by overheating*. Result: the Partitioner is always ready to use.

▶ The unit takes less space on the table than a copy of THE LABORATORY, is only 5¾″ high. Rectifier and regulator circuits are completely transistorized as an aid in achieving compactness and stability—plus long, trouble-free service. Price of the new Constant-Current Supply: $125.

The Fisher Model 25 Gas Partitioner is always ready to use, thanks to the development of the new constant-current d-c power supply (right).



Generous capacity is keynote of new Dec-O-Gram balance

A FULL 2610-gram weighing capacity—higher than that of any balance in its class—is a feature of the Dec-O-Gram Balance, a useful new instrument for educational and industrial laboratories alike.

Designed by Ohaus as a companion to their bestselling 311-gram-capacity Cent-O-Gram Balance (described in THE LABORATORY, vol. 28, no. 2), the Dec-O-Gram achieves its generous capacity by the use of 3 attachment-weights included with each balance and conveniently stored in the base.

The sensitivity of ±0.5 g and a long service-life are assured by painstaking design and construction. The high-strength "box-end" triple beam is constructed of die-cast aluminum alloy, with ends *cross-braced.* Result: greater strength and rigidity under loads. The bearings are specially mounted so as to be free to align themselves with the beam knife-edges at all times.

Rapid reading

The high-quality steel knives themselves are heat-treated for maximum hardness at the wearing surface. The *sliding-type poise,* with center indicating panel, assures rapid reading and eliminates the troublesome secondary oscillations common to hanging-type poises, while the graduated end reading device eliminates any visual parallax error.

Other features we noted: 6″-diameter removable pan, pan bow, and tiered graduated beams, all stainless steel for corrosion resistance; long-lasting baked epoxy paint on all other parts; dust-proof bearing covers; movable beaker-support platform and supporting hook for specific-gravity determinations; integral spirit-level and adjustable leveling screws on the base; compact size (14½″ W x 15″ H x 6″ front-to-back).

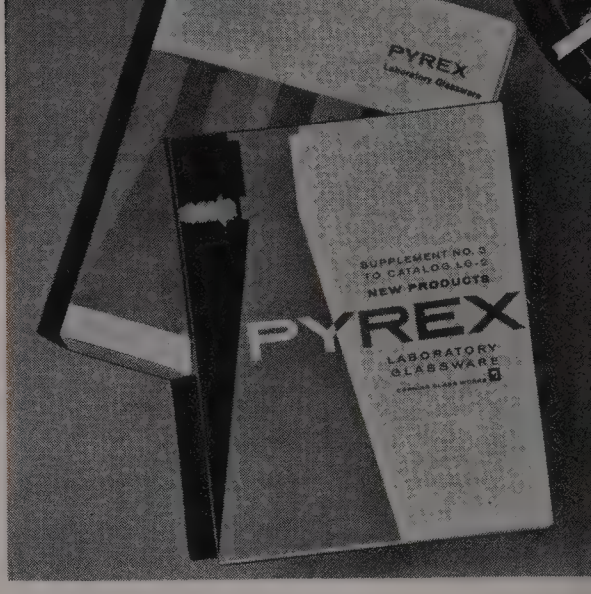
Two models

▶ The Dec-O-Gram Balance, METRIC MODEL, is offered with the triple beam graduated as follows: *front* beam, to 10 g, in 0.1-g units; *center* beam, to 500 g, in 100-g units; *rear* beam, to 100 g, in 10-g units. Price: $42.

▶ The Dec-O-Gram is also available in an AVOIRDUPOIS MODEL, with a capacity of 5 lb, 2 oz, and with the triple beam graduated as follows: *front* beam, to 1 oz, in $\frac{1}{64}$-oz units; center beam, to 16 oz, in 1-oz units; rear beam, to 1 oz, in 0.01-oz units. Sensitivity: ±0.005 oz. Price: $48.

FROM CORNING: A BULLETIN WITH

New products galore



YOU'D THINK that the 6000 types and sizes of PYREX, VYCOR and CORNING glassware in the giant PYREX *Labware Catalog LG-2* (most complete glassware reference ever printed) would suffice. But no—there's no rest for the development engineers of Corning Glass Works. Their 45 newest offerings are described in a new 8-page supplement to Catalog LG-2. Here are some highlights, all available from Fisher:

▶ **"TWO FACED" REAGENT BOTTLE**—this narrow-mouth 125-ml bottle, with polyethylene stopper, is lettered (green enamel on white enamel background) on *both sides* of the bottle, making it ideal for use on a divided lab bench; labels are easily read from either side. Available with 6 different labels, or blank. The price: $1.70 each.

▶ **"SAFETY" CYLINDER**—this graduated cylinder, single metric scale, calibrated-to-contain, with pour-out and hexagonal base, and permanent "Accu-red" markings, has a *reinforcing bead* near the top that significantly reduces breakage should the cylinder upset. Numerals are BIG. Available in 10, 25, 50, 100 and 250-ml sizes. Prices start at $2.10.

▶ **COVER GLASSES**—now you can buy CORNING cover glasses, No. 1½ thickness, in all standard sizes of squares, rectangles and circles, and at a new low price (you can even combine them with other standard PYREX labware for generous quantity discounts). The No. 1½ encompasses the 0.18-mm thickness specified by leading microscope manufacturers for optimum performance with high-power dry objectives. Typical prices: $2.30 per 1-oz dispenser pack of squares or rectangles; circles, $4.10.

▶ **REPLACEABLE** — new PYREX heavy-wall filtering flask reduces tubulation breakage appreciably. But—should the tubulation be hit hard enough to break—you can easily make the flask serviceable again by inserting a new tubulation. The heavy-duty tubulation is seated in a neoprene grommet that acts as a shock-absorber, also permits a broken tubulation to be pressed out with the fingers, a replacement inserted. Flasks come in 250, 500 and 1000-ml sizes; $1.95, $2.50, and $3.90, each. Additional glass tubulations: 25¢; additional grommets: 5¢.

▶ **HANDY HEAT**—the new VYCOR immersion heater is ideal for acids, plating solutions, general lab heating purposes. Uses infrared radiation as well as conduction and convection, so is fast, efficient. Electrical heating element is completely enclosed in red VYCOR sheath, comes with cord, ready to plug in. All 3 models (250, 500, 1000 watts) operate on 120 volts. VYCOR assures freedom from chemical and ion contamination, even at elevated temperatures. Price of 14"-long 250-watt model: $12.75.

▶ **BUNDLES**—finally, we draw your attention to bundles of assorted sizes of standard-wall PYREX tubing, packaged expressly for users with limited tubing requirements. Each 25-lb bundle contains an assortment of 10 different sizes (3, 4, 5, 6, 7, 8, 9, 10, 11 and 12-mm OD). Price per bundle: $39.15.

Naturally, all above items (except tubing) may be assorted with other PYREX labware for substantial discounts. (For the first time in Corning history, former 500-case prices apply to 150-case lots.) For a copy of the 8-page new products bulletin, check "PYREX Supplement" on the reader-service card. A limited number of the 298-page PYREX *Labware Catalog LG-2* are also available on "first-come-first-serve" basis; check *it* on the reader-service card as well.

ELECTRON MICROSCOPY WITH THE JEM-T6

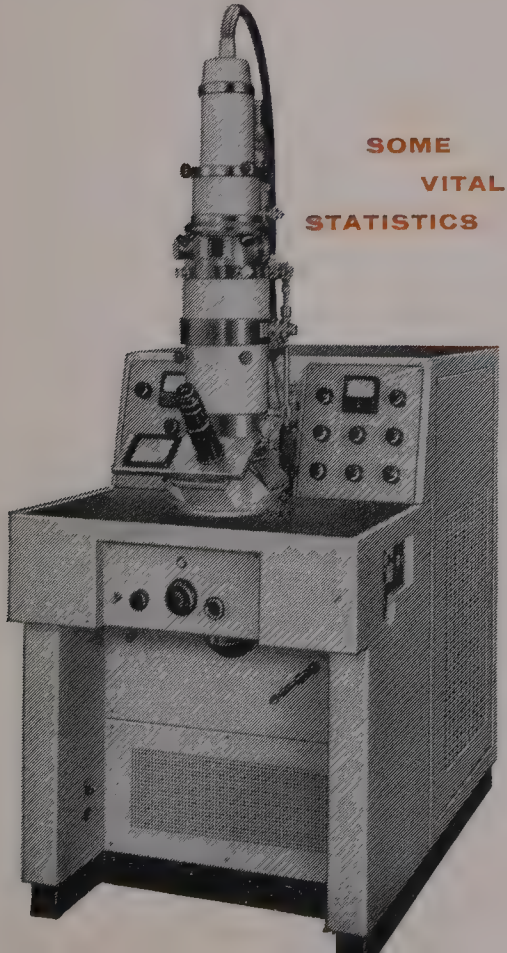
IMPORTANT! — *Public Law 87-95 (July 20, 1961) permits any non-profit society, institution or organization—whether public or private—incorporated or established for educational, scientific or therapeutic purposes, to import electron microscopes and their parts or accessories into the U.S. duty-free. Any institution that qualifies for this duty-free status need only furnish Fisher with evidence of its status, and the duty-free price will apply.*

IF YOU ARE in a laboratory where an electron microscope for transmission micrography, with resolution better than 20 Angstroms . . . 30,000X direct magnification . . and 60-kilovolt accelerating voltage will do the job you want, we don't know of a finer one than the JEM-T6.

This "T6" is a *true electromagnetic microscope,* more readily and precisely adjustable than instruments using permanent magnets that must be moved mechanically to focus or change magnification. Its price is as low as, or lower than, those of less satisfactory instruments—and you may be able to buy it *duty-free.*

Like the more expensive microscopes made by Japan Electron Optics Laboratory Co., Ltd. (JEOL), the JEM-T6 has its own high-stability high-voltage power supply . . . vacuum system . . . built-in plate (or 70-mm film strip) camera. It can record both selected-area and (with an attachment) high-resolution electron diffraction patterns. Check the table of specifications.

Your mark beside "JEM-T6 Electron Microscope" on the reader-service card will bring you data on the entire JEOL line.



SOME VITAL STATISTICS

Resolving power	better than 20A
Direct magnification	500X–30,000X (continuous)
Accelerating voltage	60 KV
Voltage stability	2×10^{-5}/min
Specimen mobility	2 mm square
Specimen area for electron diffraction	1 μ triangle
Operating vacuum	10^{-4} mm Hg
Over-all dimensions:	
Microscope	43" L x 30" W x 81" H
Power unit	22" L x 22" W x 29" H
Net weight:	
Microscope	1102 lb
Power unit	353 lb
Camera capacity	24 plates, 65 x 90 mm
Attachments:	
High-resolution electron diffraction	
70-mm film strip camera	
Binocular telescope viewer	
Dark-field (Bragg) image obtainable	
Power required	2 KW, 160-240 volt, 50/60-cycle 3-phase a-c
Cooling water (25°C)	2 liters/minute
Duty-free price	$20,096
Duty-paid price	$23,516

"CUT!" say Yale movie-makers to chemistry profs' problems

IT ONLY LOOKED quiet this past summer at Yale University's Sterling Chemistry Hall on the ivied sun-dappled New Haven campus.

Inside Room 242, chemical movie-making was in progress on a major scale. Here, in their 1600-sq ft "studio," Associate Professor Andrew Patterson (of the Yale chemistry department) and writer-director David G. Anderson (Yale audio-visual center), sparked by a $150,000 grant from the National Science Foundation, were embarked on a 3-year project of 57 films to aid college freshman-chemistry and advanced high-school instructors with their increasingly complex teaching job, in a unique way.

▶ The uniqueness: the films are all short, most are silent. After intensive study over a previous 24-month period, on 22 earlier films, Patterson had become convinced that the relatively long, narrated film that's standard fare is the wrong approach for the abstract and theoretical material covered in college chemistry.

This material demands *personal interchange* between student and teacher; a *step-by-step* unfolding of abstract concepts; opportunity for the student to raise questions at *each* of the steps. Conventional films, Patterson feels, "come between teacher and student, replace rather than assist the teacher . . ." Soundtracks are an even greater disadvantage: they address the student directly, usurp teacher's role.

Yale's answer: 31 very brief, silent films,

Director Anderson takes light-meter reading on his "star" (Professor Patterson), in shooting of short, effective demonstration film on titration.

carefully designed to demonstrate vividly just one point (LeChatelier's principle; titration; the production of x-rays).

Teacher supplies his own narration, insures his central role; several films can be shown in one period, or one film repeated several times for emphasis; and the borderline student in the back row (who can't quite make out just what's going on during a demonstration) can now see all the details, magnified on the screen.

In addition to these 31 new-style 4-minute "demonstration" films, the movie agenda includes 16 "summary" films (length: 6 minutes) to review and supplement the short films; plus 10 "comprehensive" films (10 minutes each) to cover routine repetitive information that doesn't actually require the instructor's presence. (These cover such "how-to-do-it" topics as the use of balances, the designing of an experiment.) The "summary" and "comprehensive" films will, of course, utilize soundtracks.*

Thanks to the National Science Foundation, the Yale movie-makers will be able to make preliminary copies (called "work prints") of their films available free of charge to any accredited colleges and high schools that want to try 'em. (Included with the work prints: excellent "storyboards," word-&-picture summaries, that let the teacher know exactly what points and emphases will be made.) In turn, the *teacher's* comments will aid Patterson and Anderson in putting the films into final form, for moderate rental to schools in the future.

▶ THE LABORATORY salutes the Yale movie-makers and the Foundation for joining in a project that will assist chemistry instruction everywhere.

**Incidentally, optional soundtracks and scripts are planned for making the 4-minute silent "demonstration" films suitable for high school use.*

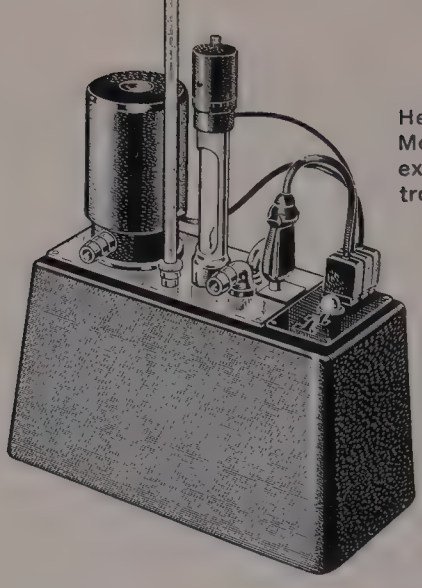
bulletin board

■ **FISHER PREP/PARTITIONER™**—booklet describes speedy new preparative gas chromatograph. Inject sample, collect components—that's all there is to preparing ultra-pure organics. *Check reader-service card.*

■ **MICRO VAPOR PRESSURE • 1300**—the facts-'n-figures on the MVP • 1300 Apparatus, which is 5 to 10 times more precise, 3 to 4 times faster than traditional Reid apparatus; will measure vapor pressure of everything from crude oils to high vapor-pressure aviation fuels, and the higher-boiling viscous samples above the gasoline and jet-fuel ranges; has digital read-out. *Check reader-service card.*

■ **FISHER-WHEELER SIEVE-SHAKER** — in this data-filled booklet, lab people learn how to bring greater reproducibility, economy, convenience to particle-sizing. *Check reader-service card.*

■ **FISHER MacMICHAEL VISCOSIMETER** — new improved apparatus measures viscosities from water to chocolate, paints, glues, heavy oils: a range of over 1,000,000 centipoises. Precise temperature control; reproducible rotation rates; standardized plungers; precise leveling; easy-to-read scale. *Check reader-service card.*



Here's the Model F Circulating Pump; the Model FSe looks just like it, but has an extra suction pump and a heavy-duty electronic relay built in. Control is precise.

These circulating pumps have thermostated reservoirs

TODAY'S LABORATORIES work at a level of precision that leaves no room for uncontrolled temperature fluctuations. That's where Haake thermostated circulating pumps come in.

These self-contained pumps can circulate temperature-controlled water, oil, alcohol or other liquids through the jackets of polarimeters and refractometers . . . through the condensers of micro-extraction and distillation set-ups . . . and to baths of all kinds.

Fisher stocks two models: the Haake MODEL F "Ultra-Thermostat" Pump has a ½-gallon reservoir and pumping capacity of 2½ gallons a minute; it's used primarily for *closed* systems.

MODEL FSe has both the regular pump and a suction pump of 1 gal/min capacity, so that it easily regulates *open* baths. Reservoir size and pressure-pumping capacity of both pumps are identical.

In both models, the temperature of the liquid in the pump reservoir is controlled by a mercury-contact thermometer that responds to changes of only ±0.005°-0.02°. This operates through a mercury relay to control two immersion heaters in the reservoir. Below room temperaure, it can be used to control a pump or solenoid valve in an external system circulating coolant through coils in the reservoir.

Fisher's own test lab has had no difficulty holding a closed-circuit system within ±0.05°C below 70°C, and within ±0.1°C above 70°, using the MODEL F.

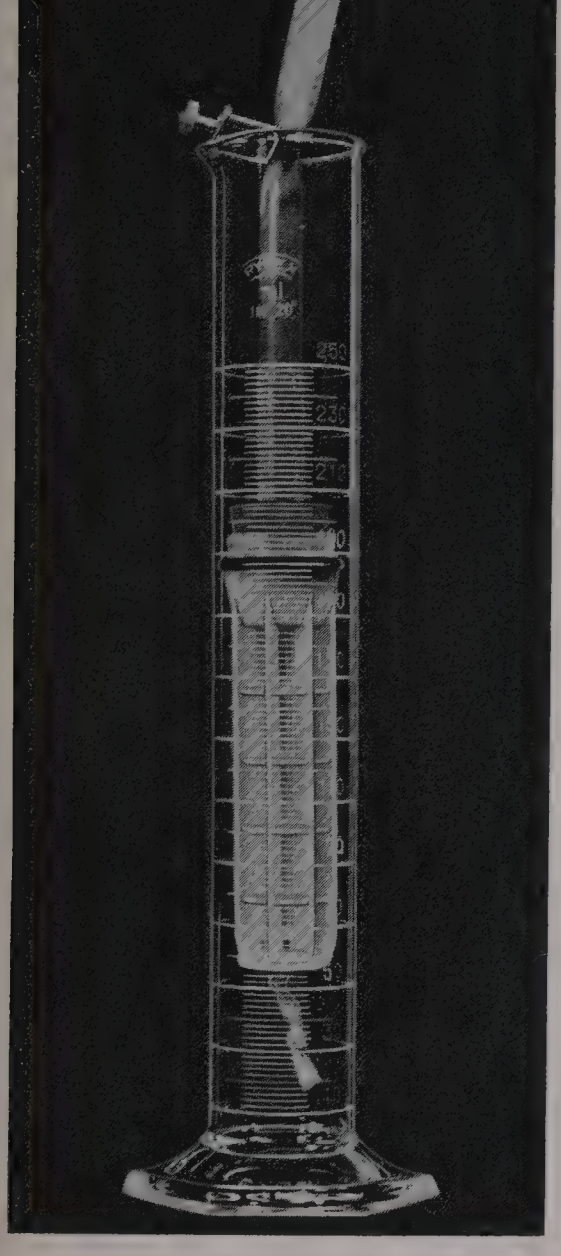
The MODEL FSe has a heavy-duty electronic relay that makes it the recommended model when apparatus is to be operated continuously, over long periods of time.

Fisher is stocking pumps with thermostats for the 0° to 100°C range. (Other controls for sections of the range from –60° to 150°C are available on special order for both models.)

A 100-watt immersion heater controls the temperature below 70°C. A 500-watt heater is used to reach operating temperature quickly, and as the control heater above 70°. Water is heated from 20° to 100°C in 20 minutes.

Reservoir and housing are stainless steel and plastic, heat-resistant and non-corroding. Pump and reservoir measure only 6″ by 12″, and are 8″ high.

▶ The Haake pumps operate on 115-volt 60-cycle a-c and are supplied with two 6-ft lengths of oil-resistant synthetic rubber hose. MODEL F, with pressure pump only, is $315. MODEL FSe, with both pressure and suction pumps and a heavy-duty relay, is $378.



The liquid below the bottom of the Ultrafilter is all you'll have left wher. the concentration is finished.

NOW CONCENTRATE

by dialysis, with the effective new Ultrafilter

WHEN AN INORGANIC chemist wants to concentrate a solution, he can usually evaporate it down—but that's out of the question for a biochemist, who works with huge complex molecules that are likely to be broken up by heat. For *him,* Fisher has the LKB Model 6300A Ultrafilter.

▶ For example: Have a series of tremendously diluted protein or enzyme fractions from a paper chromatography separation? Concentrate them with the Ultrafilter.

▶ Want to concentrate a specimen of urine *before* you isolate the hormones it contains by electrophoresis? Again—use the Ultrafilter.

▶ How about reducing the volume of a suspension of bacteria *without* changing the pH or ion concentration? The Ultrafilter will let you do that, too.

It's easy

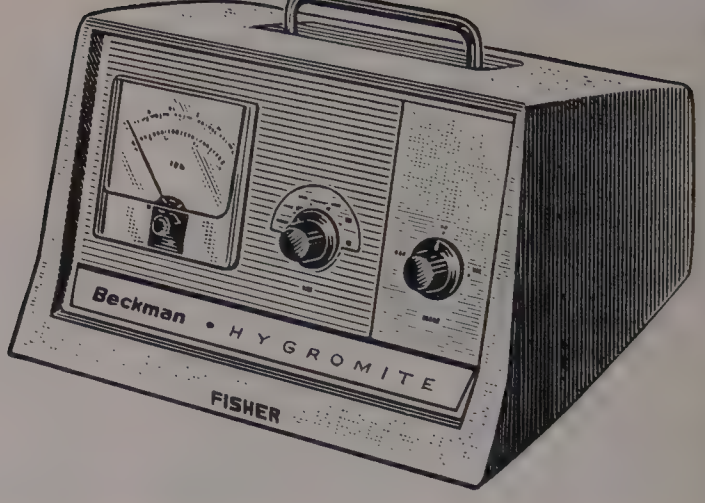
You simply stretch a short section of seamless cellulose dialysis tubing over an open nylon frame, tie off the end, and attach the open end of the filter tube to a vacuum pump (an aspirator will do). Immerse the whole unit in the solution to be concentrated.

As long as there is a vacuum inside the filter tube, the solvent, dissolved ions—in fact, any solute with a molecular weight less than 30,000—passes through the cellulose, leaving over-size particles behind. When the liquid level falls below the bottom of the filter (or when the tube is full of liquid), filtering action stops.

Concentration is relatively fast: up to 14 ml/hr. *And the process is so gentle that it can be used with materials that are even denatured by freeze-drying.* The solution comes in contact only with the glass cylinder that contains it and the cellulose dialysis membrane. The Ultrafilter can be sterilized in an autoclave at 125°C, and it's small enough so that the concentration can be carried out in a refrigerator.

▶ The Ultrafilter, complete with 6½ ft of dialysis tubing, is $14.90.

Fisher stocks additional 1⅛″ diameter dialysis tubing for the Ultrafilter as catalog no. 8-667; it's 75c per 25-ft roll, $2.00 for 100 ft. We'd also like to suggest a filter pump (catalog no. 9-985) with built-in vacuum gauge and stopcocks on both water and vacuum lines. It's $28.



Moisture monitor is mighty mite

HERE'S a portable electrolytic moisture meter that answers the need for a precise, reliable, versatile method to meet the increasingly rigid control of moisture in gases. It's called the Beckman Hygromite, and it reads directly in ppm.

Continuously monitoring water vapor in the 1-1000 ppm range, the Hygromite provides rapid response to moisture changes, permitting speedy detection and correction. The design of the electrolytic cell and the use of P_2O_5 as absorbing medium assure that the cell will remove and electrolyze all the water present.

Applications for the Hygromite are, of course, many: monitoring gas in purge systems; monitoring efficiency of gas-dryers; measuring moisture content of helium for precise chromatography; monitoring "dry-boxes"; checking water content of bottled gases; monitoring natural gas in petroleum research labs and pilot plants—you name it.

Typical gases that can be monitored: air, argon, butane, carbon dioxide, carbon monoxide, ethane, ethylene, Freon 12, Freon 22, helium, hydrogen, methane, neon, nitrogen, oxygen, propane, propylene (max., 100 ppm H_2O), saturated halogenated hydrocarbons, and sulfur dioxide.*

A glance inside

What happens in the Hygromite is this: the sample is passed continuously, at constant flow rate, through the cell, where the moisture is absorbed by the thin P_2O_5 film held between platinum electrodes.

A d-c potential, applied between the electrodes, dissociates the absorbed water into hydrogen and oxygen, producing a current (directly proportional to the water concentration) that becomes the linear signal driving the indicating meter. The signal may also be used to drive a potentiometric strip-chart recorder.

Increases in water content present the greatest danger in most processes. Hence the fast detection and corrective measures provided by the Hygromite. To wit: 63% response in 5 seconds, to any stepwise change upward, between 80 and 100 ppm. For downward changes, a change of between 1000 and 80 ppm produces 63% response in 20 seconds.

Weighing only 11 lb, and measuring a scant 11″ W by 6½″ H by 6½″ front-to-back, the Hygromite is easily carried about, has a high-impact-resistance case for rugged day-to-day use.

The 67½-volt battery permits operation where 115-volt a-c power is unavailable.

**Of course, gases that react with P_2O_5 to alter absorption characteristics of the P_2O_5 film (ammonia, other basic gases), or gases that react with the film to produce additional water by dehydration (the alcohols), can't be measured. Neither can gases that polymerize to form a solid or liquid phase that will gradually desensitize and/or clog the cell (unsaturated hydrocarbons, such as the alkynes, alkadienes, and alkenes—higher than propylene—come to mind).*

(For recorder operation, output span can be varied from 0 to 100 mv simply by adjusting potentiometer from rear panel.)

A range switch permits selection of 6 meter sensitivity positions: the "stand-by," for putting the Hygromite into operating condition and drying the electrolytic cell without causing an off-scale meter or recorder reading; plus 10, 30, 100, 300 and 1000-ppm positions that determine full-scale meter sensitivity in ppm of water by volume. Full-scale accuracy: ±5%.

The integral flow control system is easily adjustable (via screwdriver, through rear panel) to maintain sample flow of 100 cc/min. Sample-pressure requirement is 10 to 100 psig, but the instrument can also be adapted for atmospheric pressure samples by using an auxiliary vacuum pump.

▶ The Hygromite, for 115-volt a-c or battery operation, is $495, battery included. It comes complete with standard electrolytic cell for gases whose hydrogen content is 50% or less. Additional standard cells: $132 each.

▶ A special hydrogen electrolytic cell, for gases whose hydrogen content exceeds 50%, is also $132. It represents a major achievement in moisture detection in hydrogen streams, eliminating traditional woes of catalytic re-forming of H_2O within the cell and subsequent remeasurement, and assuring accuracy unobtainable by cell calibration or varying the flow rate. The Hygromite can be supplied with this special cell instead of the standard cell at no extra cost, or the hydrogen cell can be ordered separately.

▶ Recommended for *continuous* measurement of gas flow is the sample-&-bypass flowmeter accessory (140 cc/min is maximum on the sample flowmeter; 2 cubic ft/hr, on the bypass flowmeter). Price is $145.

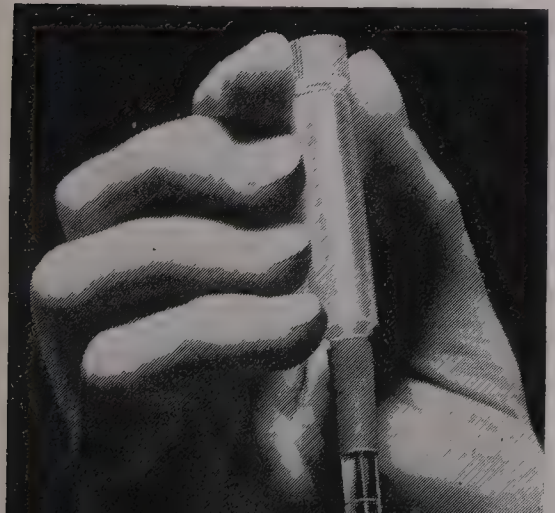
For an illustrated leaflet, check "Hygromite" on the reader-service card.

IN NEW SAFETY PIPETTOR

One hand does it

THE LEFT HAND doesn't *have* to know what the right is doing, when you use the new Accropet pipettor. Compact design provides one-hand operation, makes for speedy filling, accurate discharge.

Attach the device to the pipet with a short length of rubber tubing or a one-hole rubber stopper, then operate the fill-&-discharge knob by thumb and forefinger while the pipettor body is held in place with the three remaining fingers. Liquid is drawn up the pipet by rotating the knob upward, discharged by rotating downward.



You don't have to risk drawing up cyanide solutions, acids, dyes and bacterial infusions by mouth suction, yet can fill or dispense accurately—as you *cannot* with a rubber bulb on the pipet.

The Accropet is high-temperature polypropylene, withstands temperatures to 320°F, has O-ring construction for positive leak-proof action. The tubing connection makes for flexibility, helps eliminate pipet breakage.

▶ The ultramicro model, for pipets up to and including 0.2 ml, and especially recommended for lambda pipets, is $3.50 ($16.80 per 6-pack). Micro model, for pipets up to and including 2 ml, is $4.95 ($23.70 per 6-pack).

instrument panel

10 years of arsenic analyses supply facts 'n figures on chief methods

A DECADE of running analyses on arsenic in smelter effluents and associated biological samples has given chemists at Canada's Department of National Health & Welfare, Ottawa, a validly magisterial view of the relative merits of the 3 major methods. In other words, they know whereof they speak.

In addition, while retaining the usual analytical requirements of accuracy, sensitivity and specificity, the chemists modified the techniques and apparatus to get the maximum analyses per day.

▶ So, for facts—and excellent tables of figures—we direct you, in this air-polluted age, to the pages of *American Industrial Hygiene Association Journal,* 22:292-295 (August 1961), for a comparison of the Gutzeit, the Vasak-Sedivec, and the iodine-microtitration methods for arsenic in air and biological materials. (Check "Industrial Hygiene Reprint" on the reader-service card for your copy.)

While the Gutzeit is specific and simple, and lends itself to large-scale analysis, its results are greatly affected by numerous variables (temperature, gas flow-rate, humidity of gas stream, catalytic traces in system). And while titration is excellent for suitable samples (water, air, stack effluents), the catch is that substances reacting with iodine—other than arsenic—must be absent.

The best all-around method seems to be the Vasak-Sedivec, which covers a wide range of concentrations, is reproducible from run to run. Apparatus used for this is the Fisher ARSINE GENERATOR; the reagent is Fisher SILVER DIETHYLDITHIOCARBAMATE.

▶ Both procedure and instrumentation are described in a technical bulletin available without charge; check "Silver Diethyldithiocarbamate" on the reader-service card. (Note: the technique's also of interest to petroleum refining chemists and others determining arsenic in ppb.)

Zone-refining, initially for semi-conductor metals, serves organics, too

MELT OR FREEZE, the chemist can't lose. "It is highly probable," writes E. A. Wynne in *Microchemical Journal,* 5:175-183 (June 1961), "that through continued research and apparatus refinement, those organic substances difficult to purify at present will be available for purification by the zone-melting technique."

On the other hand, zone-*freezing* equipment may soon be available for obtaining purity of 99.999999 mole-% of organic solvents. "Indications from the National Research Council and National Bureau of Standards seem to predict such ultra-purity." Round the corner looms the possibility for doing same for *in*organic salts.

The article, a handy guide, describes the zone-refining of organics . . . gives tables showing the resultant increase of melting point, and elemental analyses . . . describes a readily-available commercial apparatus, the FISHER ZONE-REFINER, for refining chemicals with m.p.'s of 50°-300°C . . . winds up observing "zone-refining is a valuable adjunct to the microchemist."

▶ For the Wynne article, check "Microchemical Reprint" on the reader-service card. For a detailed booklet on the *apparatus,* check "Fisher Zone-Refiner."

Vibratory polishing can speed metal specimen preparation 300%

ONE OF THE MOST PROMISING efforts to automate time-consuming work in the

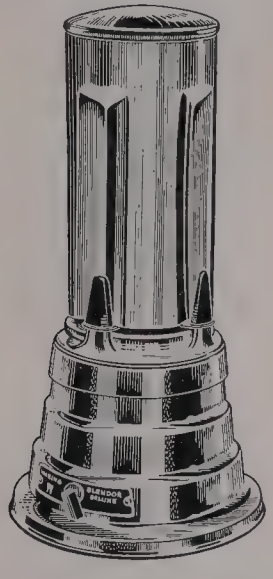
modern metallographic laboratory is vibratory polishing. So write Paul Rothstein and F. R. Turner, of Jones & Laughlin Steel Corporation's Graham Research Laboratory, in a major paper describing optimum procedures for the new technique.

Quotable quote: "The production rate of vibratory polishing can exceed 3 to 4 times the production rate of hand polishing, and results are reproducible even if different types of materials are polished simultaneously. One can produce excellent polishes even if he has little metallographic training."

Thus, they note, the skilled metallographer can apply his time more efficiently . . . can investigate the more advanced procedures necessary to a modern laboratory.

▶ Originally published in ASTM "Symposium on Metallographic Specimen Preparation," STP 285 (1960), the paper and its photo-micrographs are now available in condensed form as a Fisher technical bulletin (check "Metallographic Reprint" on the reader-service card).

▶ For a detailed booklet on the commercially-available FISHER VIBROMATIC™ POLISHER, which handles 20 different samples simultaneously, check *its* name on the reader-service card, too.



HIGH-SPEED BLENDOR

meets widest variety of lab requirements, at nominal price

LABORATORIES requiring a heavy-duty lab mixer-blendor at a *nominal price* and in a *standard quart size,* will find the answer in the new Waring Model LB-1 Blendor.

It features a high-power high-torque motor; a *stainless-steel* container in Waring's exclusive "cloverleaf" (easy grip, easy pour) design; and a highly-polished chrome base—all in a compact 8¾ lb unit. It's ideal where heavy usage . . . freedom from breakage . . . and controlled, sanitary preparation of samples are required.

At the turn of a switch, the LB-1 provides two different blade speeds: HIGH (20,500 rpm) and LOW (12,600 rpm). With this range of power, the unit mixes, blends, chops, liquefies and whips samples into homogeneous masses, foaming mixtures, emulsions, suspensions, solutions—in *seconds.*

The container holds 37½ oz, resists effects of corrosive atmospheres, galvanic corrosion, mine water, crude oil, gasoline, blood, perspiration, alcohol, ammonia, mercury, soap and sugar solutions, salt spray, all food-stuffs, most organic chemicals, and mineral acids and solutions of their salts.

▶ Price of the new LB-1: just $59.95. Rating: 4.25 amps, 510 watts, at 115 volts a-c or d-c.

NOTE: also available from Fisher are such useful Waring Blendors as the STANDARD MODEL, speed 10,000 rpm (price: $34.95), and its ICE JET ATTACHMENT ($16.95) that gives finely crushed ice, fast; the ASEPTIC DISPERSALL ($199.50), that fits on the Standard Model base, reduces infectious materials with perfect safety to personnel; and the gallon-capacity KING-SIZE BLENDOR ($295), with speeds of 14,000, 17,000, and 19,000 rpm in one rugged heavy-duty model. See *Catalog 61* ("Modern Laboratory Appliances").

Small & speedy

VORTEX JR. MIXER

YOU WON'T have to flip, shake or stir the contents of test tubes any more if you use the ingenious little device pictured here: the Vortex Jr. Mixer. Flip the switch, and a neoprene cup atop the Mixer starts to oscillate. Touch a test tube to the cup, and the oscillation is immediately transferred to the liquid in the tube, *mixing contents thoroughly in a split second.*

Use the Vortex Jr. for small tubes and large tubes capped or uncapped, round, square or odd-shaped, culture tubes, serological tubes, centrifuge tubes—the whole gamut.

Works just fine, too, with small Florence, Erlenmeyer or volumetric flasks, once you've caught the knack of applying just the right pressure at the proper angle.

There's no need to cap a tube unless it's more than half full. And sponge-rubber feet and a heavy base keep the Mixer from "creeping."

▶ Here's a tip from some big labs that swear by the new Vortex Jr.—it's inexpensive enough that you can have one on every bench, ready for instant use. It may pay to have one beside each colorimeter or spectrophotometer to guarantee that *all* samples are homogeneous. The Vortex Jr., in stock at your nearest Fisher branch, for use on 115-volt 60-cycle a-c, is only $59.50.*

**If you need a Mixer for 220-volt 50-cycle a-c, that's only $5 more. A foot switch for the Mixer, at $12.95, is available on special order, as are heavy-duty variable-speed Vortex Mixers that hold 2 or 4 tubes at a time.*

NEW FILTER

puts the finger on magnesium

THERE'S added versatility to flame photometry, with the Magnesium Filter designed for Coleman's 21 Flame Photometer.

The MODEL 21, used with the popular Coleman Junior and Universal Spectrophotometers, has enabled researchers to measure, with accuracy, *sodium* in the range 0.05-5 meq/liter (1.2 - 120 ppm); *potassium* in the range 0.02 - 18 meq/l (0.8 - 700 ppm); and *calcium* in the range 0.02 - 1 meq/l (0.4 - 200 ppm).*

**In addition to the Junior and Universal Spectrophotometers, the Flame Photometer Attachment can be used with the Coleman Galv-O-Meter, Photo-Nephelometer, Nepho-Colorimeter and Colorimeter.*

Now, Fisher offers a Coleman Filter that enables the MODEL 21 Flame Photometer to isolate the 382 mμ emission line of magnesium. With the new filter, magnesium is detected in the range 0.4 - 320 meq/l (or 5 - 4,000 ppm); *the upper limit can be raised still higher by partially masking the filter.*

Magnesium in aqueous solution can be determined directly with less than 2% interference error from potassium or calcium when these are present in an amount no greater than 15% of the magnesium present. Sodium creates no appreciable error when present in an amount no greater than 3% of the magnesium present.

▶ Price of the Magnesium Filter is $88. Supplied with each filter: a copy of the complete analytical procedure for magnesium determination.

PHOSPHORUS IN THE LIMELIGHT

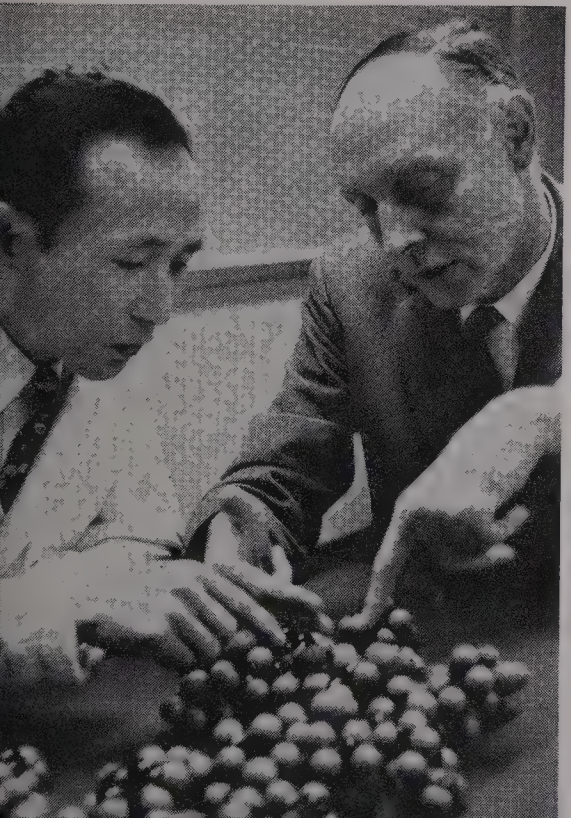
New scaled models of phosphate and phosphine forms available

CONSTANTLY INCREASING research interest in phosphorus by chemists, biochemists, biologists and physiologists alike, has prompted the addition of that element to Fisher Scientific's comprehensive line of Fisher-Hirschfelder-Taylor atom models.

With the new F-H-T models of *phosphate* and *phosphine* phosphorus, researchers and instructors can "synthesize" and study, in 3-D, molecular structures that conform to authoritative data on size, space relationships, bond angles and interatomic distances. They can probe such vital points as the role of phosphorus in regulating bodily functions.

Snap-fasteners facilitate construction even of giant organic molecules, which will not separate under structural strain; yet these patented fasteners permit individual atoms and radicals to be turned readily at experimental angles.

Scaled atom models are a major 20th Century research tool. Here, Drs. Haruaki Yajima and Klaus Hofmann study the biologically active part of synthetic ACTH molecule. It was biochemist Hofmann who achieved ACTH synthesis.



The new phosphorus atom models, like the models in the 86-atom F-H-T Organic Model Kit and the 87-atom F-H-T Metal-Coordination Kit, are precision-molded in plastic to hold dimensions to fine tolerances. The identifying colors (magenta for the new phosphorus atoms) are an integral part of the plastic body, cannot fade, chip or rub off.

All F-H-T models are scaled 100,000,000 to one. Since molecules are measured in Angstrom units (1A = 1/100,000,000th of a centimeter), this means that you need merely lay a meter stick across the completed F-H-T molecule to get an approximate idea of the size of the "real" molecule in Angstroms.

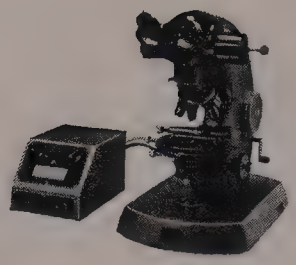
▶ The "Phosphate" Phosphorus Atom (Type P-1) has 4 faces, 3 with single valence bonds, one with a double bond.*

▶ The "Phosphine" Phosphorus Atom (Type P-2) has 3 faces, each with a single valence bond.

The P-1 and P-2 Atom Models are $1.00 each, or $10.80 per dozen of one type. Like the Silicon (Type Si-1) and Fluorine (Type F-1) Atom Models, the new models are offered separately and are not part of the standard kits.

For a booklet on F-H-T *individual models and standard kits—their theory and applications—check "Fisher Atom Models" on the reader-service card.*

*SINGLE *valence bonds are "built-in" the face of the model via a single receptacle (for a snap-fastener) in the center of the face; the* DOUBLE *bond is indicated by a single receptacle, plus an adjacent upright pin, plus a hole in the face diametrically across the center to receive the pin on the connecting atom, hold it in the right position. Thus, it is impossible to "combine" atoms in any manner valence-wise unrealistic.*



NEW FROM FISHER:

the automatic, completely-integrated Zeiss microscope-&-camera

IT'S a whole new level of convenience, simplicity and accuracy in laboratory photomicrography—the Photomicroscope, available in the growing Zeiss line offered by Fisher and serviced by Zeiss-trained Fisher representatives.

▶ The Photomicroscope is no complicated combination of microscope-with-added-camera, *but a unique microscope-&-camera instrument completely integrated for simple, automatic operation.*

Once the specimen is focused in the eyepiece of the Photomicroscope, you merely push a button: the instrument *automatically* opens the shutter, sets the exposure time by electronic control, closes the shutter after exposure, transports the film for the next picture, advances the picture counter, and re-cocks the shutter.

No need to bother with exposure times, changing of plates, transporting of film. You are free to concentrate completely on microscopic study. And Zeiss's century-plus record of precision workmanship assures a lifetime of dependable use.

The scope

The microscope itself is unitized into a few basic parts: stage, condenser, nosepiece-with-objectives, and eyepiece tube, all quickly removed, all easily replaced.

The mechanical stage—round, rotary, and centerable—is interchangeable with a variety of other specimen stages.

The two 8x Komplan eyepieces, of new design, compensate for any chromatic magnification difference of the objectives, achieve an extra flattening of the eyepiece image field needed for best results with the Plan series of objectives recommended for photomicrography. The binocular inclined tube gives uniform vision, *prevents eye strain even after prolonged work.*

A built-in Optovar (situated above the nosepiece-&-objectives) provides a quick change of eyepiece magnification.

Also built into the Photomicroscope is a "projective" lens system that offers two image scales simply at the turn of a knob. The table below shows image scales available by using projective and Optovar systems together.

PROJECTIVE	OPTOVAR 1.25x	OPTOVAR 1.6x	OPTOVAR 2x
3.2:1	4:1	5:1	6.3:1
6.3:1	8:1	10:1	12.5:1

A LETTER TO THE EDITOR—*"The boldest conceptions, the most legitimate speculations, can only be embodied from the day they are consecrated by observation and experiment. Laboratories and discoveries are correlative terms. If you suppress laboratories, science will become stricken with barrenness and death, will become mere powerless information. Give it back its laboratories—and life, fruitfulness and power will reappear. Away from their laboratories, chemists and physicists are but disarmed soldiers on a battlefield."*

—Louis Pasteur, 1865, writing to the official paper, THE MONITEUR

Fisher Zeiss specialist demonstrates new integrated microscope-camera. In his hand: precision research camera.

Zeiss's Planachromat objectives range from 2.5x to 100x, with numerical apertures from 0.08 to 1.25. They have been designed to eliminate, as far as possible, all image curvature, and are especially recommended for photomicrography with *transmitted* light.

For photomicrography with *reflected* light, Fisher offers Zeiss's new Epiplan objectives. (They cover the same range as the Planachromat objectives, but offer in addition a 10x lens with 0.22 aperture; 25x with 0.45 aperture; and 63x with 0.90 aperture.)

Also available are Neofluar objectives for bright-field and phase-contrast work. (These range from 16x with a 0.40 aperture to 100x with a 1.30 aperture.)

Objectives are set in resilient spring mounts, which yield when the objective touches the cover-glass, affording money-saving protection for slides and lenses.

The camera

Built right *into* the Photomicroscope is the automatic research camera. The film is placed in a removable drum-shaped magazine which is inserted into the body of the stand. (Ordinary 35-mm daylight film cartridges can be used.)

Once the magazine is inserted, it is rotated slightly; this simultaneously locks it to the stand, couples it with the operating mechanism, opens it to permit light to reach the film.

To disengage, use another slight rotation. This automatically closes the magazine and makes it possible—simply by exchanging magazines—to take consecutive black-&-white *and* color shots of the same specimen. An automatic photoelectric device assures proper exposure. (You may also expose manually.)

Optics & illumination

The Photomicroscope can be used for either transmitted light or reflected light needed for opaque samples. To convert to reflected light, merely press a lever on the side of the stand.

If only microscopic work is to be performed, all of the light (whether transmitted or reflected) can be channeled directly from specimen to eyepiece. For photography, a slide inserts a system of prisms that directs the light first to the camera, then to the eyepiece.

An integral low-voltage high-intensity lamp, firmly mounted to the base of the Photomicroscope, provides ideal illumination for ordinary microscopic work and for photomicrography in bright-field, dark-field and phase-contrast work.

This Koehler illumination assures the back lens of the objective of full illumination, makes the best use of resolving power, eliminates any "fogging" of the image.

▶ Price of the Photomicroscope varies according to the objectives, filters, condensers, and other optional items ordered. *Check "Zeiss Line" on the reader-service card for a complete price list on the Photomicroscope,* as well as a fluorescence microscope, photomicrographic apparatus, 35-mm research cameras, and other fine Zeiss instruments distributed and serviced by Fisher.

TWO NEW FURNITURE UNITS THAT LET YOU

Do more with the space you have

Left: sink
Right: cabinet

1. Unitized Corner Sink

FISHER makes the lab sink go stand in a corner—the space most often wasted in laboratory installations—and frees valuable benchtop areas for instruments, for apparatus, for *work*. Moreover, the sturdy new Fisher Corner Sink Unit has generous *storage* capacity for solvents, equipment, containers.

Basin of the new unit (8″ deep by 16″ wide by 12″ front-to-back) is one-piece, solid Durcon, with curved corners and bottom "dished" to the outlet. Durcon resin exhibits almost complete resistance to the wide range of acids, alkalies, salts, solvents, and organics used in today's laboratories. It is a thermosetting resin; high heats will not melt it. And its impermeability to moisture absorption prevents staining by even the intense dyes of textile, biological and clinical procedures.

The unit itself is heavy-gauge steel throughout, Bonderized for adherence and rustproofing (by full immersion in phosphate baths), then carefully finished with 5 coats, including *3 baked-on coats of enamel*. The color, handsome contempory Unitized Gray, matches that of all other Fisher units identically.

Each Fisher Corner Sink Unit is supplied complete with gooseneck faucet, Durcon basin, tellurium-treated lead plug, trap-&-overflow, Kemrock top grooved for drainage, and acidproof basswood splashback-&-reagent shelf, finished in black to match the top. Kemrock, as lab users know, is the special resin-impregnated sandstone resistant to just about all chemicals.

The new Fisher Corner Sink Unit is available in two heights:

▶ *The 36"-high model* forms a continuous working surface with other "standing-height" units, and is available as catalog number 17-085. Price: $305.20. (Without reagent shelf, the unit's top gains 7" in front-to-back work-space. Catalog number of the 36"-high sink with extra-deep top is 17-085-20. Price: $293.20.)

▶ *The 30"-high model,* otherwise identical to the 36"-high unit in design, construction and accessories, forms a continuous working surface with other "sitting-height" units, and is available as catalog number 17-086. Price: $303.20. (Without reagent shelf, the 30"-high sink with extra-deep top, catalog number 17-086-20, is priced at $291.20.)

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2. Unitized 18" Cabinet

FISHER condenses the popular all-drawer unit, heretofore available in 2-ft and 4-ft widths, into a slim 18"-wide unit, bringing laboratories new flexibility and versatility in expanding within the particular space available.

▶ *The "standing-height" model* is 36" high by 22" front-to-back, yet has 4 roomy unpartitioned drawers, 14⅝" W by 5 7/16" H by 18" front-to-back.

▶ *The "sitting-height" model* is 30" high by 22" front-to-back, with 4 roomy unpartitioned drawers 14⅝" W by 3 15/16" H by 18" front-to-back.

All drawers of the new 18"-Wide Drawer Unit ride on nylon ballbearing rollers (concealed in channels) for smooth operation, while safety catches prevent untimely removal of drawers—and spilled contents. The drawer pulls are coated with chemical-resistant black plastic resin, which complements the contemporary Unitized Gray of the cabinet.

Fisher offers 3 different working tops for its new 18"-Wide Drawer Units: Kemrock, Formica, stainless steel.

The Formica top is backed by a 9-layer plywood base 1¼" thick, with a drip-groove under the front edge to prevent spillage on the unit's front. Like the Kemrock top, it comes complete with acidproof basswood splashback-&-reagent shelf, finished in black.

The gleaming stainless-steel top, type 316 alloy, is one-piece construction with *integral* stainless-steel splashback-&-reagent shelf, and is highly resistant to common laboratory reagents. Carefully cut neoprene strips close the joints between adjacent units in an assembly to produce a liquid-tight fit.

Extra-deep tops, with a front-to-back surface of 30", adding about 23% to the work area, are available in Kemrock, Formica and (on special order) stainless steel.

TOPS:	KEMROCK	FORMICA	STAINLESS
18" 4-Drawer Unit 36" high	17-009 $137	17-009F $135	17-009S $194
Same, with extra-deep top	17-009-20 $131	17-009-20F $129	Special order
18" 4-Drawer Unit 30" high	17-009-5 $135	17-009-5F $133	17-009-5S $192
Same, with extra-deep top	17-009-50 $129	17-009-50F $127	Special order

All Fisher Unitized Furniture is available, at all times, direct from stock. Units are completely independent, standardized, interchangeable, can be recombined at later dates to form new arrangements to meet changing laboratory requirements. *For an illustrated 16-page catalog of the entire line, check "Fisher Unitized Furniture" on the reader-service card.*

ON THESE NEW METERING PUMPS

You dial the flowrate

IT'S AS EASY to control the rate at which you add reagents to a reaction kettle, administer parenteral fluids, or "bleed off" production-stream samples for analysis . . . as it is to dial a telephone.

In fact—if you use Beckman's new Solution Metering Pumps—it's easier than phoning. You dial *one* number—the flowrate you want. The pump will deliver liquid at that precise rate, down to a fraction of a milliliter per minute, with an accuracy of ±2% of the rated range, a repeatability of ±0.5% of capacity.

▶ Fisher offers a choice of 4 pumps in the new line. They differ only in capacity: 0-2, 0-5, 0-10, or 0-20 ml/min. All can be used at ambient temperatures running from 50° to 110°F, to pump liquids whose temperatures range from 10° to 80°C and whose viscosities extend from 1 to 100 centipoises. Prices of the 4 pumps are identical, too: $265, each. Please specify capacity.

Regulation of the pumping rate is completely mechanical. A fan-cooled motor rotates a cam at a fixed rate. The cam operates a spring-loaded piston and opens and closes the spring-loaded inlet and outlet valves. A pre-calibrated Duodial controls the length of the piston stroke, and consequently the volume of liquid delivered at each stroke.

This design eliminates the high backpressures necessary with many other pumps *and assures leak-free performance.*

All components in contact with solutions are of chemical-resistant materials: glass, Teflon, Penton chlorinated polyether resin, or Viton hexafluoropropylene-vinylidine fluoride copolymer. They are tough, and can be sterilized if necessary.

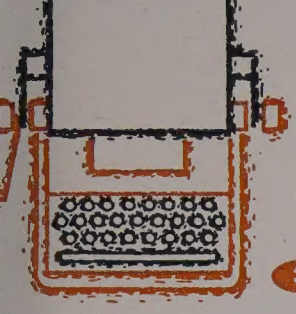
With standard Viton diaphragms, the pumps can be used with most mineral and organic acids and bases, alcohols, and aliphatic or aromatic hydrocarbons, but should not be used with 60 + % nitric acid, hydrofluoric acid, concentrated sulfuric acid, saturated sodium hydroxide, aqua regia, ketones, esters or ethers.*

The pumps are a compact 5″ x 6½″ x 5″ high, light (3¾ lb), and operate on 115-volt 60-cycle a-c. They can stand on the bench or be wall-mounted. Removal of the solution-handling components for cleaning or sterilization is easy. Inlet and outlet have ¼″ NPT female fittings, and Beckman supplies a pair of Teflon tube fittings that will connect the pump to any kind of glass or metal line.

For a bulletin on these dial-the-flowrate appliances, check "Beckman Pumps" on the reader-service card.

*If any of *these* materials are to be pumped, the user can replace the Viton with butyl rubber diaphragms ($7.60 a pair), which handle most liquids except aliphatic, aromatic and halogenated hydrocarbons, concentrated sodium hydroxide, or strong mineral acids.

Set the dial and the pump delivers. You can use it to circulate fluids in closed systems too if pulsing flow's acceptable.



et cetera

MICRONAUTS — just as we're getting used to the incredible detail electron microscopes are showing us inside ultra-thin slices of tissue, along come French scientists with studies of *living bacteria* made right in their electron 'scopes.

What makes this amazing is that electrons are so easily scattered by the molecules in air that the entire interior of an electron microscope must be kept under high vacuum if images are to be sharp, definition high. But in a vacuum, bacteria would burst.

Also: a run-of-the-mill bacterium is too thick — about *10,000* Angstrom units thick—to let electron beams go through; only a few *hundred* Angstrom units of tissue will absorb an electron beam, giving an unsatisfying silhouette minus all detail.

▶ In a recent communication to the French Academy of Sciences (*Comptes rendus,* 251:2836-2841 [1960]), microscopists Duproy, Perrier and Durrieu tell how they solved both problems: the vacuum, the thickness.

First, they "souped up" their microscope till they could use accelerating voltages of 1,000,000 volts (even the advanced JEM-6C Electron Microscope described in the last issue of THE LABORATORY stops at 100,000). At the new high voltages, electrons travel at 94% the speed of light, go through bacteria with ease.

Next, they devised a fantastic ultra-microscopic "space capsule" for the bacteria —a capsule with only 2 to 10 microns of air space—to protect the tiny passengers from the effects of vacuum. The Frenchmen even found a way to *air-condition* the tiny capsule to keep the air humid, the bacteria healthy—and reproducing!

ONE WORLD—there's another good story in the magazine itself in which we found the report on the micronauts.

The magazine's name is "Global Technology," it's new, and it's printed by Trans-World Publishing Co., Euclid at East 170th Street, Cleveland 6, Ohio.*

▶ Every month, "Global Technology" brings readers brief translated abstracts and summaries of papers from scores of hard-to-find European and Asiatic technical journals, government publications. If you want more, you order a photostat of the original article, complete with English translation, for only 75¢ a page.

TABLE TALK—equally newsworthy is the Institute for Scientific Information, 1122 Spring Garden Street, Philadelphia 23, Pa., whose "Current Contents" family of magazines provides reproductions (and translations, if necessary) of the *table of contents* of current issues of hundreds of the world's leading scientific journals.

▶ The weekly "Current Contents of Chemical, Pharmaco-Medical & Life Sciences" covers over 600 journals; the weekly "Current Contents of Space & Physical Sciences," over 500; and the unique twice-a-month "Index Chemicus" reports and indexes all papers and communications dealing with new chemicals — more than 60,000 in 1960.*

All you get is the *titles* of new papers —but you get 'em months before abstracts become available. Nice?

**Sample copies of the magazines are available from the publishers. Please write* THEM—*not us; our secretary absolutely refuses to give up our dog-eared but treasured copies.*